

**METHOD FOR CONNECTING A FIRST USER-TERMINAL TO A SECOND
USER-TERMINAL, RELATED DEVICES AND RELATED SOFTWARE**

MODULES

Background of the Invention

5 *sub* The present invention relates to a connecting method as described in the preamble of claim 1 and the related devices as described in the preamble of claims 6, 8, 10, 11, 12 and 13.

Such a method for connecting a first user-terminal to a second user-terminal is already known in the art, e.g. from the internet draft document "A
10 *FRAMEWORK FOR IP BASED VIRTUAL PRIVATE NETWORKS*" from the authors Bryan Gleeson et al, published in February 1999 by the Internet Engineering Task Force (IETF). Therein, a virtual private network is constituted by configuring all network access server access links, called stub-links in the referred draft, with the identity of the particular virtual private network whereto
15 the access link of the network access server belongs.

In this way each user-terminal is assigned to a particular virtual private network in a static way. Each of the user-terminals assigned to a common virtual private network are able to establish a communication with any other user-terminal assigned to the same virtual private network because
20 information on the address of each connected user-terminal, called reachability information is available within the virtual private network.

At the moment there is a first user-terminal being assigned to a first virtual private network willing to establish a communication with a second user-terminal being assigned to a second virtual private network there is no way of
25 connecting both user-terminals in order to establish a communication because there is no information available on the address of the second assigned to the second virtual private network.

An object of the present invention is to provide a method of the above known type, a system, a network access server, a subscriber data server
30 and a second user-terminal adapted to perform this method, but wherein access from a first user-terminal connected to a first virtual private network is

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able to connect to a second user-terminal connected to a second virtual private network.

Sub
ary According to the invention, this object is achieved by the method described in claim 1, the network access server described in claim 6 and 8, the
5 subscriber data server described in claim 10 and 12 and the second user-terminal as described in claim 11 and 13.

Indeed, due to the fact that a subscriber data server is added to the network and that the necessary connection information is made available enabling to determine the location of the second, to be connected user-
10 terminal. This network element, the subscriber data server is able to store and retrieve information on which the network access server the second user-terminal is connected to and the virtual private network the meant user-terminal forms part of. At a connection request from a user-terminal forming part of a different virtual private network, the subscriber data server retrieves the
15 connection information about the second user-terminal in order to locate this user-terminal. Subsequently the subscriber data server forwards a connection request to the located second user-terminal. The second user-terminal in its turn decides on accepting the incoming call. If the incoming call is accepted, the user-terminal forwards a request to the network access server the user-terminal
20 is connected to, to switch its connection from the current virtual private network to the first virtual private network. At the moment the switch is performed, both user-terminals form part of the same virtual private network. Then they are able to establish a communication because address information of the second user-terminal is available and accessible for the first user-terminal in this context.

25 Another characteristic feature of the present invention is described in claims 2 and 7 and in claim 3.

Summary of the Invention
The connection request of the first user-terminal may be sent from the subscriber data server to the second user-terminal via the network access server where this network access server in a active way forwards the
30 connection request received from the subscriber data server to the second user-terminal. On the other hand the connection request may be passed, as

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implementation of the method and the related devices according to the present invention will be described. In the first paragraph of this description the main elements of this network as presented in FIG. 1 are described. In the second paragraph, all connections between the before mentioned network elements and described means are defined. In the succeeding paragraph the actual

execution of the method for connecting a first user-terminal to a second user-terminal is described.

An essential element of this embodiment of the present invention is a network constituted by the internet network INW. Further there is a number of user-terminals, but in order to keep simplicity in this description only two user-terminals UT1, UT2 are presented. Both user-terminals UT1 and UT2 are chosen to be a personal computer with a belonging screen and keyboard. Additionally there is a number of access nodes connecting each of the user-terminals to the internet network INW and taking care of subscription of the connected user-terminals to a virtual private network. Concerning these access nodes, also because of reasons of simplicity only three access nodes NAS1, NAS2 and NAS3 are described and presented in FIG. 1. These access nodes NAS1, NAS2 and NAS3 are chosen to be network access servers.

User-terminal UT2 is connected to network access server NAS1 via an Internet protocol link, further referred to as an IP-link. User-terminal UT1 is connected to network access server NAS2 via an IP-link. The network access servers NAS1, NAS2 and NAS3 each constitute the edge of the internet network INW and are all interconnected via the internet network. The subscriber data server SDS is connected to each of the network access servers NAS1, NAS2 and NAS3 over an IP-link.

The network access node NAS1 as presented in FIG. 2. is built up of the switch notification reception means SNRM, that is able to receive a request from the second user-terminal UT2 to initiate a switch-over of the connection of the second user-terminal UT2 from a second virtual private network to a first virtual private network, the switching means SM that is adapted to perform the switch of the connection of the second user-terminal from a second virtual private network to a first virtual private network and a user-terminal connect notification sending means HCNSM that is adapted to send registration information to the subscriber data server at connecting or changing of the subscribed virtual private network of the second user-terminal to the respective network access server NAS1.

The switch notification reception means SNRM has an input-terminal that is at the same time also an input-terminal I_4 of network access server NAS1. The switch notification reception means SNRM further is coupled to the switching means SM which in its turn is coupled to the user-terminal connect
5 notification sending means HCNSM, that has an output-terminal which at the same time is an output-terminal O_0 of the network access server NAS1.

This network access server NAS1 optionally has the following means. At first there is a connection establishment request reception means CERRM1 that is adapted to receive a connection request from the subscriber
10 data server to establish a connection between the first user-terminal UT1 connected to a first virtual private network and the second user-terminal UT2 connected to a second virtual private network. Further there is a connection establishment request sending means CERSM1 that is able to notify the second user-terminal UT2 about an incoming call from the first user-terminal
15 UT1.

The connection establishment request reception means CERRM1 has an input-terminal that at the same time is an input-terminal I_2 of the network access server NAS1. The connection establishment request reception means CERRM1 in its turn is coupled to the connection establishment request sending
20 means CERSM2 that subsequently has an output-terminal that is at the same time an output-terminal O_2 of the network access server NAS1.

Besides these means the network access node NAS1 as presented in FIG. 2. may also comprise a connection establishment request reception means CERRM2, that is adapted to receive a connection request from the
25 second user-terminal to establish a connection between the second user-terminal connected to the second virtual private network and the first user-terminal connected to a first virtual private network and a belonging connection establishment request sending means CERSM3, that is adapted to notify the subscriber data server about an incoming call from the second user-terminal.

30 The connection establishment request reception means CERRM2 has an input-terminal that at the same time is an input-terminal I_4 of the network

access server NAS1. The connection establishment request reception means CERRM2 in its turn is coupled to the connection establishment request sending means CERSM3 that subsequently has an output-terminal that is at the same time an output-terminal O₄ of the network access server NAS1. These latest
5 mentioned means optionally are to be included in a network access server and excluding all other, previously mentioned means.

Network access server NAS2 and Network access server NAS3 have the same structure as the Network access server NAS1 as previously described.

10 The Subscriber Data Server SDS as presented in FIG. 3 is built-up of the user-terminal connect notification reception means UTCNRM that is able to receive the connection information sent at connecting of the second user-terminal UT2 to network access server NAS1 or at switching a connection from one virtual private network to another. The user-terminal connect notification
15 updating means UTCNUM is adapted to update the database DB of the subscriber data server with the connection information. Further there is a connection establishment request reception means CERRM that is able to receive a connection request from the first user-terminal UT1 to establish a connection between the first user-terminal connected to a first virtual private
20 network and the second user-terminal connected to a second virtual private network. The registration information searching means RISM is adapted to search in the database DB of the subscriber data server SDS for recent registration information of the second user-terminal UT2, and the connection establishment request sending means CERSM1, that is adapted to notify the
25 second user-terminal about an incoming call from a first user-terminal.

The user-terminal connect notification reception means UTCNRM has an input-terminal that is at the same time an input-terminal I₀ of the subscriber data server SDS. This user-terminal connect notification updating means UTCNRM is coupled to the user-terminal connect notification updating
30 means UTCNUM which also has an output-terminal that is at the same time is an input/output-terminal I/O₁ of the subscriber data server SDS.

5 terminal that at the same time is an input/output-terminal I/O₁ of the subscriber data server SDS and further is coupled to the connection establishment request sending means CERSM1. The connection establishment request sending means CERSM1 has an output-terminal that is at the same time an output-terminal O₁ of the subscriber data server SDS.

20 The connection establishment request reception means CERRM3 has an input-terminal that is at the same time an input-terminal I_3 of this second user-terminal UT2. Further, the connection establishment request reception means CERRM3 is coupled to the incoming call handling means ICHM, that in its turn is coupled to the switch requesting means SRM. The switch requesting means SRM has an output-terminal that is coupled to an output-terminal O_3 of the
25 second user-terminal UT2.

The network access server NAS2 as presented in FIG. 5 may alternatively being built up of a connection establishment request reception means CERRM4 that is adapted to receive a connection request from the first user-terminal UT1 to establish a connection between the first user-terminal UT1
30 that is connected to the first virtual private network and the second user-terminal UT2 that is connected to the second virtual private network and further

The connection establishment request reception means CERRM4 has an input-terminal that at the same time is an input-terminal I₅ of the network access server NAS2. The connection establishment request reception means CERRM4 in its turn is coupled to the connection establishment request sending means CERSM4 that subsequently has an output-terminal that is at the same time an output-terminal O₅ of the network access server NAS2.

According procedures that are well known in the art by the persons skilled in the art and therefor not described, the first user-terminal UT1 tries to obtain the Internet address, further referred to as the IP-address, of the to be contacted second user-terminal UT2.

Alternatively the connection request can be sent to a connection establishment request reception means of network access sever NAS2 that receives this connection request from the first user-terminal to establish a connection between the first user-terminal connected to a first virtual private
30 network and the second user-terminal connected to the second virtual private network. Subsequently the connection establishment request sending means of

This may also be performed by the connection establishment request reception means CERRM4 of NAS2 that receives this connection request from the first user-terminal UT1 to establish a connection between the first user-terminal connected to a first virtual private network and the second user-terminal connected to the second virtual private network. Subsequently the connection establishment request sending means CERSM4 notifies the subscriber data server about an incoming call from the first user-terminal.

The user-terminal connect notification sending means HCNSM sends connection information to the user-terminal connect notification reception means UTCNRM of the subscriber data server SDS at connecting of the second user-terminal to the respective network access server NAS1 or at switch-over to another virtual private network. The user-terminal connect notification reception means UTCNRM of the subscriber data server SDS receives this registration and forwards it to the user-terminal connect notification updating means UTCNUM that updates the database DB of the subscriber data server SDS with the recently received connection information. This registration information contains information to which network access server a user-terminal is connected and which virtual private network that user-terminal forms part of. There is also a list maintained for each user on which virtual private network the user has a subscription on.

The connection information searching means RISM then retrieves the connection information of the second user-terminal UT2. This connection information contains the information that the user of second user-terminal UT2 amongst others has also a subscription to the first virtual private network and

that this second user-terminal UT2 is connected to network access server NAS1 and that it currently is connected to the second virtual private network. Using this information, the connection establishment request sending means CERSM1 will notify the second user-terminal UT2 about an incoming call from the first user-terminal UT1 via a transparent connection between the subscriber data server SDS and the second user-terminal UT2 via network access server NAS1.

The notification of the second user-terminal UT2 about an incoming call from the first user-terminal UT1 may alternatively be done by sending the incoming call notification to the connection establishment request reception means CERRM1 that receives a connection request from the subscriber data server to establish the connection between the first user-terminal connected to the first virtual private network and the second user-terminal connected to the second virtual private network via the network access server. Subsequently the connection establishment request sending means CERSM2 notifies the second user-terminal about an incoming call from the first user-terminal.

The connection establishment request reception means CERRM3 of the second user-terminal receives the connection request sent by subscriber data server SDS and subsequently forwards this notification to the incoming call handling means ICHM that handles this connection request from the first user-terminal by, assume a pop-up screen requesting the user of the second user-terminal UT2 to accept an incoming call from this first user-terminal and postpone or finish the ongoing communication. If the user decides to accept the incoming call from the first user-terminal the current communication is finished and the switch requesting means SRM, of the second user-terminal requests the network access server NAS1 to switch the connection of the second user-terminal from the second virtual private network to the first virtual private network. The switch notification reception means SNRM, receives the request from the second user-terminal to initiate a switch-over of the connection of the second user-terminal from the second virtual private network to the first virtual private network and forwards it to the switching means SM that finally performs

This means that the communication between the first user-terminal and the second user-terminal further can be established according to the previously mentioned procedures that are well known by persons skilled in the art.

It is further to be remarked that any other communications network could have been described in this embodiment.

Although the above embodiment of the invention has been described by means of functional blocks, their detailed realisation based on this functional description should be obvious for a person skilled in the art and is therefore not described.

While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention, as defined in the appended claims.